# Center for Health Informatics & Bioinformatics

A New Catalyst For Cutting Edge research, Funding Opportunities, and Education at NYULMC

# Current Challenges

- Biological Research
  - Complex assays/instruments: exceed capacity to synthesize their output
  - Complex diseases/hypotheses & system-level thinking
- Clinical & Translational Research
  - Research networks
  - Data & specimen management, aggregation, processing, mining
  - Genomic and personalized medicine
- Informatics Technology & Science to Address Challenges
  - High dimensional molecular, clinical, and clinico-molecular data analytics
  - Knowledge integration and integrative data analytics
  - High performance computing
  - Information retrieval, literature synthesis, computable guidelines, quality metrics

# Biomedical Informatics

- Definitions

Biomedical Informatics=

The science that invents and studies computing methods for discovery, storage, retrieval, assessment, synthesis, and overall optimal use of biological and medical information and knowledge

Bioinformatics=the branch of Biomedical Informatics that deals with biological research

Health (Medical) Informatics = the branch of Biomedical Informatics that deals with clinical research and patient care

The NIH explicitly treats Biomedical Informatics as a unified field especially in reference to translational science

# Importance of Biomedical Informatics

A few Characteristic examples of past contributions:

- Bioinformatics
  - Sequence alignment algorithms and systems
  - Sequence assembly algorithms
  - Pathway reconstruction
  - Microarray and other omics data analytics
- Health (Medical) Informatics
  - MEDLINE
  - Electronic medical records (EMRs) and Computerized provider order entry (CPOE)
  - Reminder systems and Medical Decision Support Systems
- Translational (Biomedical) Informatics
  - Computational data analytics for molecular profiles (signatures) power diagnostic and personalized medicine

# Informatics and the NIH

- 1 NIH institute (NLM) and 5 Informatics/Computing Centers (National Center for Research Resources, Center for Information Technology, National Center for Biotechnology Information, Bioinformatics Resource Centers, National Centers for Biomedical Computing)
- Informatics training supported by the NIH since early 80s
- Informatics prominently figured in all 3 themes of the NIH roadmap (New Pathways to Discovery, Research Teams of the Future, Re-engineering the Clinical Research Enterprise)
- Critical ingredient in CTSA programs
- EMRs (Outcomes research, healthcare cost reduction, meaningful and secondary uses, etc.)
- Also: Privacy/Confidentiality/HIPPA, Recovery Act, federal earmarks, industry opportunities, etc…

# Priority development Goals for Informatics Center

- Mission of Informatics Center

  "To catalyze transformative changes in biomedicine through breakthrough computational methodological research, best practices services, state of the art infrastructure, and cutting-edge education."
- Development Horizon
  - Develop Bioinformatics, Health Informatics, Infrastructure
  - 4-year plan and milestones
- New Opportunities
  - In data warehousing
  - Text processing
  - Hospital Information Systems Evaluation

# Uniqueness of NYULMC Informatics

- Tight integration of activities and alignment to real-life research and patient care needs:
  - New methods driven by real life need (i.e., do not start as theoretical inquiries and then adapted to real life projects)
  - Work grounded on real-life complexities (i.e., not idealized and simplified to accommodate methods developer)
- Best practices approach to consultation: faculty-level consultations and execution of projects, benchmarking and methods literature assessment/synthesis.
- Theoretically and empirically rigorous approach to new methods development.
- Pursue excellence in new methods development and deployment in strategically chosen areas.

# Informatics is very broad: what are our domains of deep expertise at NYULMC?

Areas of NYULMC Informatics faculty excellence:

1. **Data analytics for diagnostic, predictive and prognostic analyses of very high dimensional data**, clinical, molecular and combined.
2. **Software, algorithms and theory for the discovery of biomarkers and pathways from very high dimensional data**, clinical, molecular and combined.
3. **Innovative and uniquely powerful models to search both the literature and the web** for high quality medical information.
4. **Systems to support and enhance medical education** via knowledge management and simulations.
5. Deep expertise in **instrument-specific informatics** including: next generation sequencing pipelines, microarrays etc.
6. Deep expertise in other methods such as **sequencing algorithms, phylogenetics, signal processing, and stochastic modeling.**
7. **Data management for research protocol data**.

# Collaborations

- Informatics acts as a central hub of scientific activity that channels information and connects a diversity of scientists, educators and clinicians. The entities that routinely and closely collaborate with BMIC/CHIBI include:
  - Genetics, Genomics Core/Microarray, Proteomics, miRNA Facility, Centers of Excellence, Cancer Center, Computational Biology, MCIT, many departments/Labs, Biomedical Library, Polytechnic.
  - Several entities in NYU with interests in developing informatics programs (SoM, Continuing Education, School of Nursing)
  - With Other Communities: other CTSAs, AMDec consortium, NG Sequencing QC consortium, Causality Challenge and workbench, Private companies.

# What have we accomplished since 11-2008: Currently available activities infrastructure, and services

1. We hired 5 new informatics faculty in critical new methods innovation and service areas.
2. We brought together 15 total faculty (10 full time, 3 part time, 2 consulting) and fostered a common academic research, teaching and educational environment.
3. We launched 3 new research informatics labs with cutting edge research:

- Molecular Signatures Lab
- Computational Causal Discovery Lab
- Evidence Based Medicine Information Retrieval and Scientometrics Lab.

4. 6 staff hires were made and staff were trained.
5. High Performance Computing Phase I design & implementation and Phase II design were completed.
6. We launched the Best Practices Informatics Consultation Service (BPIC).
7. We launched the Research and Clinical Data Base Management service.
8. We acquired extensive new computing equipment.
9. We developed fiscally responsible and sustainable Business Plans with flexible cost recovery and several free (i.e., CTSA and Dean-subsidized) service components to researchers.
10. We developed a full range of next generation sequencing informatics capabilities to support all next generation sequencing protocols.
11. We developed extensive and in-depth working relationships with MCIT, Genomics Center, Cancer Center, and numerous research labs.
12. We secured an extensive IP portfolio for free use at NYU. This portfolio powers many of our services and research capabilities as was provided to NYU free of charge for academic use.
13. We launched comprehensive educational activities: tutorials, courses, seminars, invited speakers, resident training.
14. We are leading the charge for a powerful and cost-effective design of Federated Data Warehouse and Laboratory Information Management System for all high-throughput data.
15. We supported or led >30 grant proposals.
16. We launched the comprehensive CHIBI web site (www.nyuinformatics.org).
17. We launched benchmarking activities spanning sequencing informatics methods, and pathway analysis algorithms.
18. We actively managed faculty grants and provided career mentoring: exceeding Dean' standards & moving toward consistency with national informatics RPT standards.
19. We assembled an external advisory board with 5 distinguished advisors.
20. Our faculty published >40 papers in peer-reviewed journals including highest-profile journals in biology, medicine and informatics.
21. Our faculty published 1 book and contracted 2 more.

# What have we accomplished since 11-2008: Two Highlights

## A. Establishing an academic home for informatics

1. We hired 5 new informatics faculty and 6 staff. We brought together 15 total faculty (10 full time, 3 part time, 2 consulting) and 8 trainees and fostered a common academic research, teaching and educational environment.
2. We launched 3 new research informatics labs with cutting edge research:
    - Molecular Signatures Lab
    - Computational Causal Discovery Lab
    - Evidence Based Medicine Information Retrieval and Scientometrics Lab.
3. Our faculty published >40 papers in peer-reviewed journals including highest-profile journals in biology, medicine and informatics.
    - Molecular profile multiplicity
    - Generalized local learning data analytics
    - Citation prediction
4. We launched comprehensive educational activities: tutorials, courses, seminars, invited speakers, resident training, mentored research.

## B. Re-organized and upgraded our informatics services for the NYULMC community

1. We launched the Best Practices Informatics Consultation Service (BPIC). Established formal encounter capture and SOPs.
2. We launched the Research and Clinical Data Base Management service.
3. We developed a full range of next generation sequencing informatics capabilities to support all next generation sequencing protocols.
4. We executed several benchmarking activities spanning:
    - Sequencing informatics methods,
    - Pathway analysis algorithms
    - Classifiers for molecular data
    - Biomarkers selection, and classification for high dimensional data

# Looking ahead: What are major projects, infrastructure, and services under development for this year?

1. Implementation of High Performance Computing Phase II.
2. Design, defend and launch MS/PhD/ Post-Doctoral Training program in Health Informatics and Bioinformatics.
3. Execute remaining faculty and staff hires & training.
4. Move to permanent space.
5. Issue LIMS and FDW recommendations.
6. Launch data mining unit and pilot projects.

# Who we are: Faculty

Faculty

Constantin Aliferis, M.D., Ph.D.

- Director, NYU Center for Health Informatics and Bioinformatics

Alexander Alekseyenko, Ph.D.

- Research Assistant Professor, Department of Medicine, Division of Clinical Pharmacology, NYU School of Medicine

Stuart Brown, Ph.D.

- Research Associate Professor, Department of Cell Biology, NYU School of Medicine

Yindalon Aphinyanaphongs, M.D., Ph.D.

- Research Assistant Professor, Department of Medicine, Division of Clinical Pharmacology, NYU School of Medicine

Andrew J. Bate PhD

- NYU Adjunct Faculty
- Director, Quantitative Epidemiologist, Pfizer Inc

Michael Cantor, M.D.

- Clinical Assistant Professor, Department of Medicine, Division of General Internal Medicine, NYU School of Medicine
- Director, Healthcare Informatics, Pfizer, Inc.

# Faculty CONT'D

John Chelico, M.D.

- Assistant Chief Medical Information Officer (CMIO), New York City Health and Hospitals Corporation, South Manhattan Healthcare Network

Lawrence Fu, Ph.D.

Research Assistant Professor, Department of Medicine, Division of Clinical Pharmacology, NYU School of Medicine

James Robinson, M.Ed.

- Research Assistant Professor, Department of Child and Adolescent Psychiatry, NYU School of Medicine
- Director Clinical Research Informatics Data Management, Center for Health Informatics and Bioinformatics

Peter M. Kilbridge, MD

- Chief Medical Information Officer

Yuval Kluger, Ph.D.

- Assistant Professor, Department of Cell Biology, NYU School of Medicine

Phillip Ross Smith, Ph.D., M.D.

- Associate Professor, Department of Cell Biology, NYU School of Medicine

# Faculty CONT'D

Alexander Statnikov, Ph.D.

- Assistant Professor, Department of Medicine, Division of Clinical Pharmacology, NYU School of Medicine

Jinhua Wang, Ph.D.

- Assistant Professor, Department of Pediatrics, NYU School of Medicine

Jiri Zavadil, Ph.D.

- Assistant Professor, Department of Pathology, NYU School of Medicine
- Assistant Director, NYU Genome Technology Core, NYU Langone Medical Center

# Staff

Jizhou Ai, M.S.

Scientific Programmer

Heidi Fitterling, M.P.H.

Steven Sotero, M.A.

Informatics Core Manager

Zuojian Tang, M.S.

Associate Research Scientist

Nikita Lytkin, Ph.D.

Senior Scientific Programmer

Jacquelyne Price

Administrative Assistant, Center for Health Informatics and Bioinformatics,NYU Langone Medical Center

# Trainees

Research Scientists

Ashwin R. Jadhav, M.D., M.S.

Mariann Micsinai, M.A.

Varun Narendra, M.S.

Firas Wehbe, M.D.

Kassatihun (Hilyna) Gebre-Amlak

Laura Brown, M.S.

Fabio Parisi, Ph.D.

# How can the Informatics Center help you?

- **Best Practices Informatics Integrative Consultation service**: general consulting for projects of any size with informatics needs; provides and handles references to methods developer groups, assay cores, external consultants as needed
- **Benchmarking service**: conducts comparative evaluations of informatics methods
- **High Performance Computing Facility**: for projects with intensive computing needs
- **Data base management service** (organized through BPIC): for clinical, molecular and multi-modal data
- **Informatics Research labs**: for new methods development in the areas of high dimensional data analytics, pathway discovery, pattern recognition, and advanced information retrieval/scientometrics
- **Informatics Seminars and education**: internal and external speakers, tutorials, courses, mentorship

# Learn More about the Informatics Center from our Website

www.nyuinformatics.org

# Questions ?